

PSYCHOLOGY 305

COGNITIVE PROCESSES

Agenda (p272-301)

1. Quiz
2. When does attention kick in: Early versus late selection?
3. How: Feature Integration Theory (FIT)
4. Spatial neglect

Announcements

1. All grades will be released tomorrow (thank you for your patience)

Filtering

- The problem with cocktail parties...



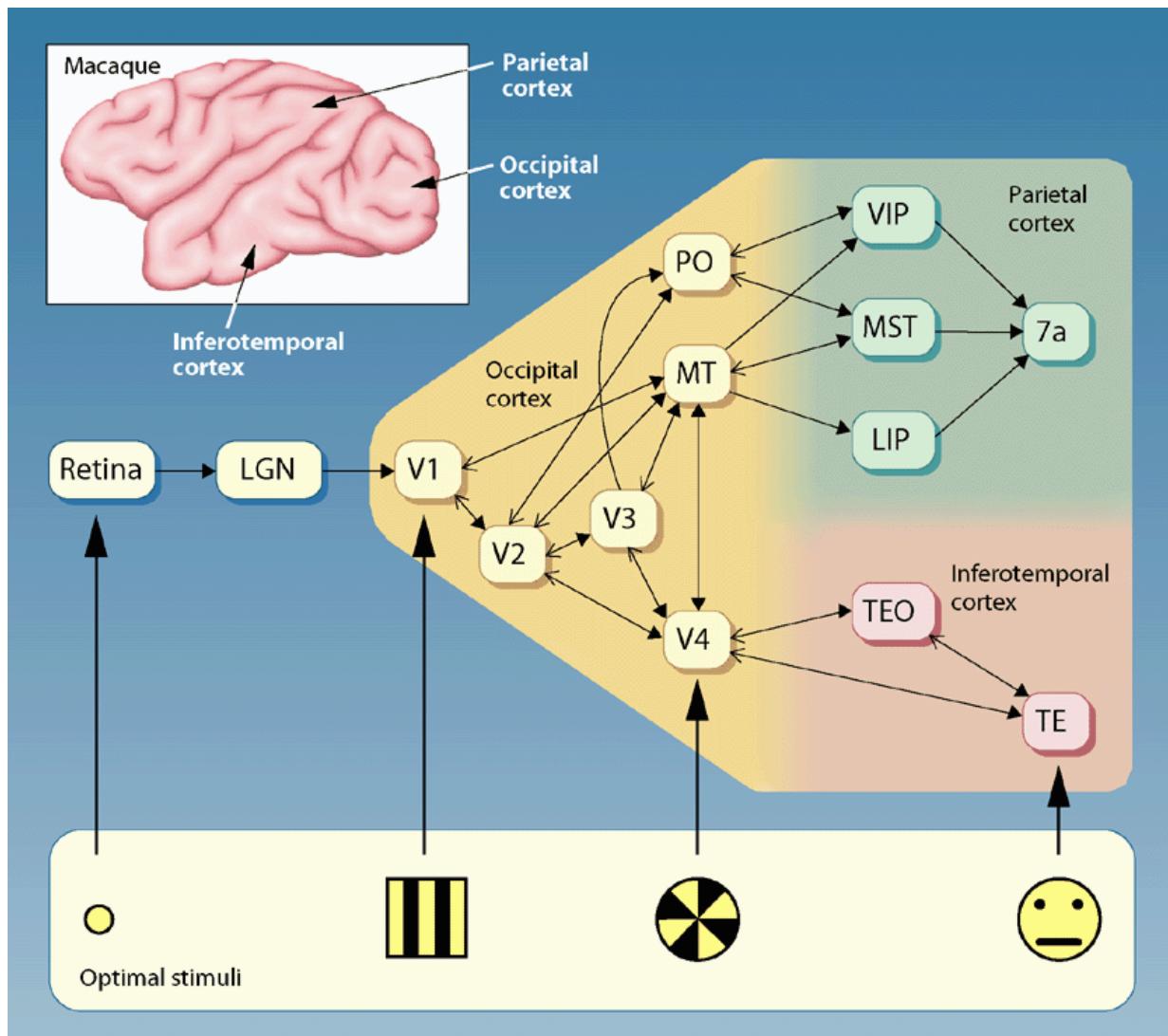
Cocktail party effect



- 3 properties:
 - Ability to select one information stream.
 - Ability to *covertly* attend to another stream.
 - Higher sensitivity to words of interest

Summary

- Limited capacity
 - “bottleneck” in processing
- Able to selectively attend to goal relevant information
 - Overtly (eye-movements), but also covertly
 - Domain general (e.g., vision, audition)
 - What is the mechanism for selection?

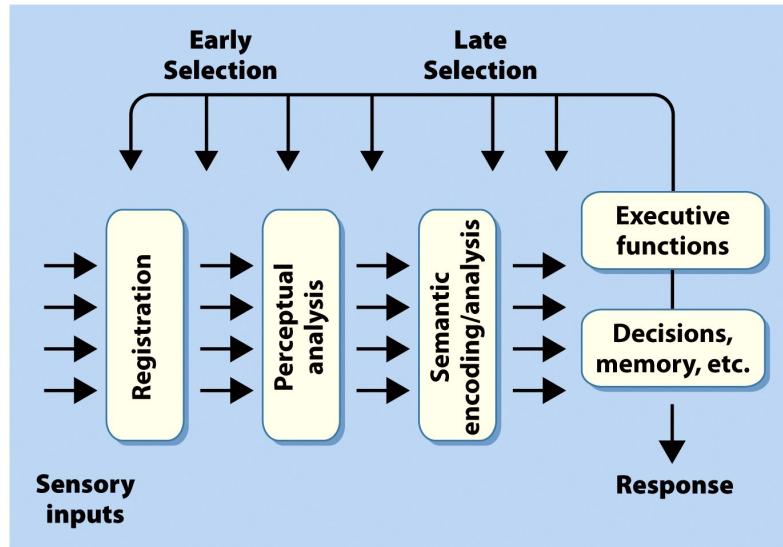


Semantic Processing

- Meaning of what you are looking at
- Ventral pathway

Early versus late attention selection

- Early – Select *sensory* information to be processed
 - Ignore friend's voice
- Late – once semantic information is processed, select which to attend to
 - Still hear friend's voice, but choose to ignore it

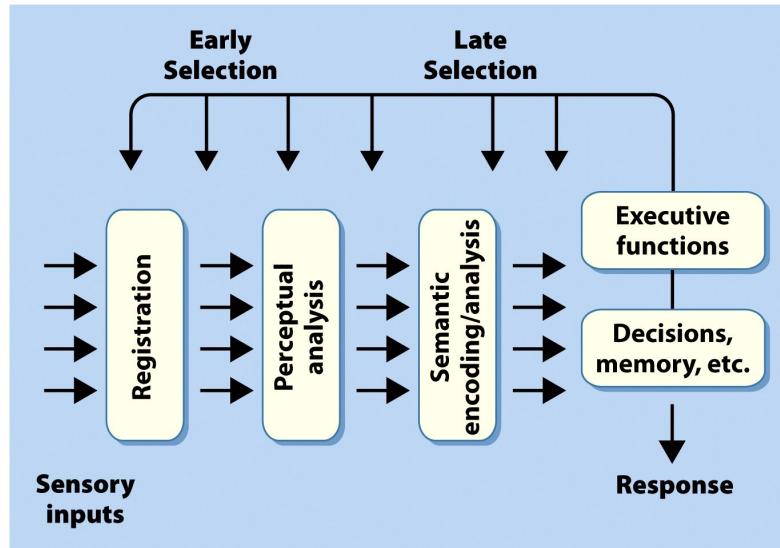


Is attentional selection early or late? (or where is the bottleneck in processing)?

Tune out friend's voice



Volume control

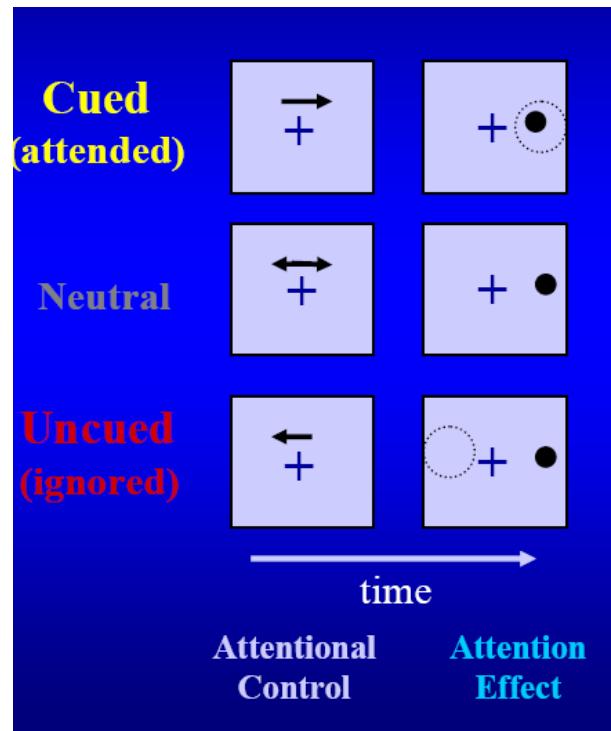


Still hear friend's voice, but ignore it



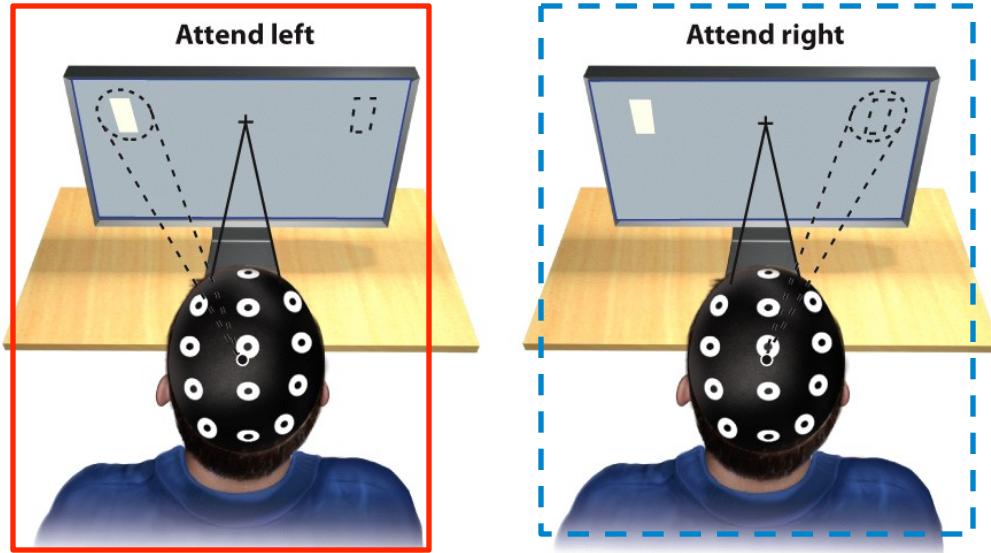
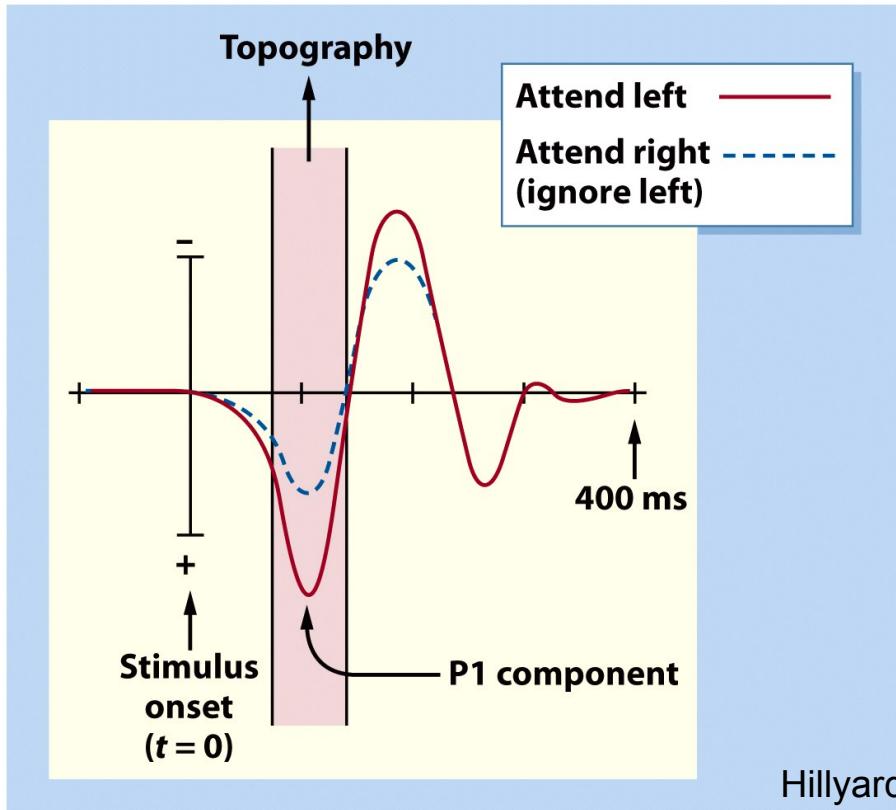
Voluntary visual spatial attention

Posner Spatial Cueing Task



Compare same sensory stimulus under different conditions of attention

Early Selection & ERP



Hillyard et al.

Electrode over right occipital cortex

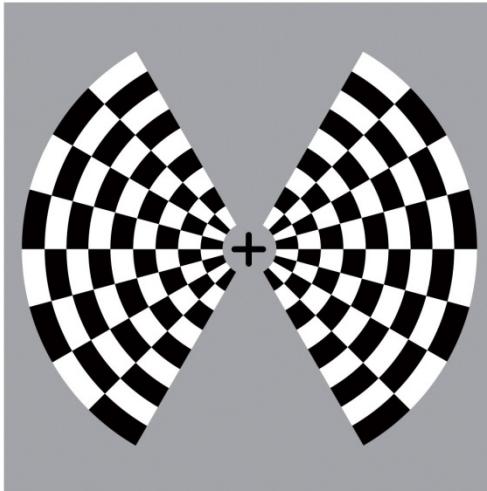
- P1 begins 70-90 ms after stimulus.
- Suggests attention amplifies perceived stimulus
- Similar findings in auditory attention (N1)

Is attentional selection early or late?

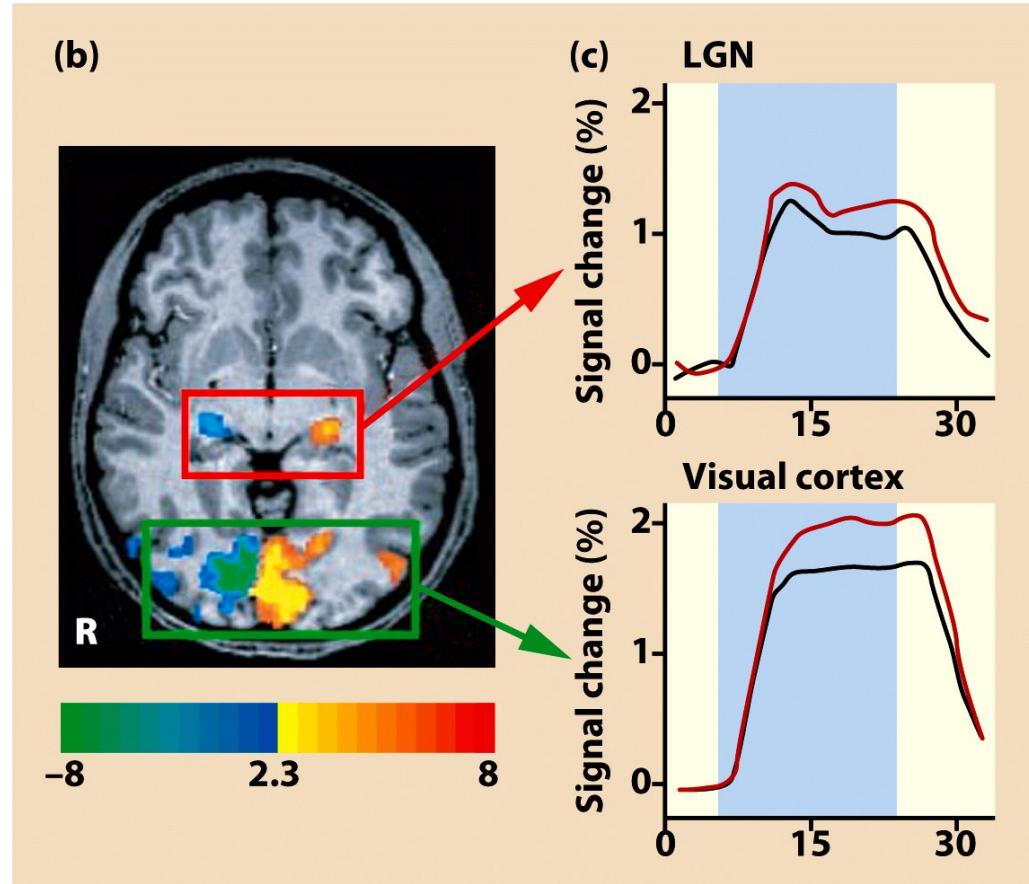
- When does voluntary attention begin to affect information processing?
 - Early.
 - Differences in auditory N1 and visual P1 due to attention begin well before 100 ms.
- Suggests incoming information is modulated as it arrives into sensory system.
 - As if a spotlight were highlighting information.



Where in the brain does voluntary attention have an effect on processing?



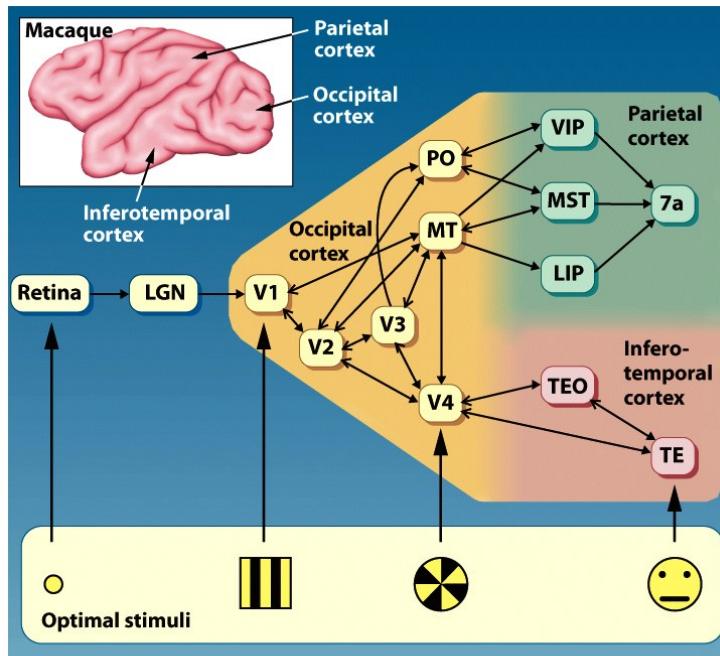
Attend to left or right
and detect
luminance change.



LGN modulated by spatial attention.

Where in the brain does voluntary attention have an effect on processing?

- Attention can modulate processing very early on in LGN and V1
 - Effectively decreases response time and increases amplitude of response.





Late selection

Stroop effect

- Clap if you see red (the color)
- Snap if red is not present

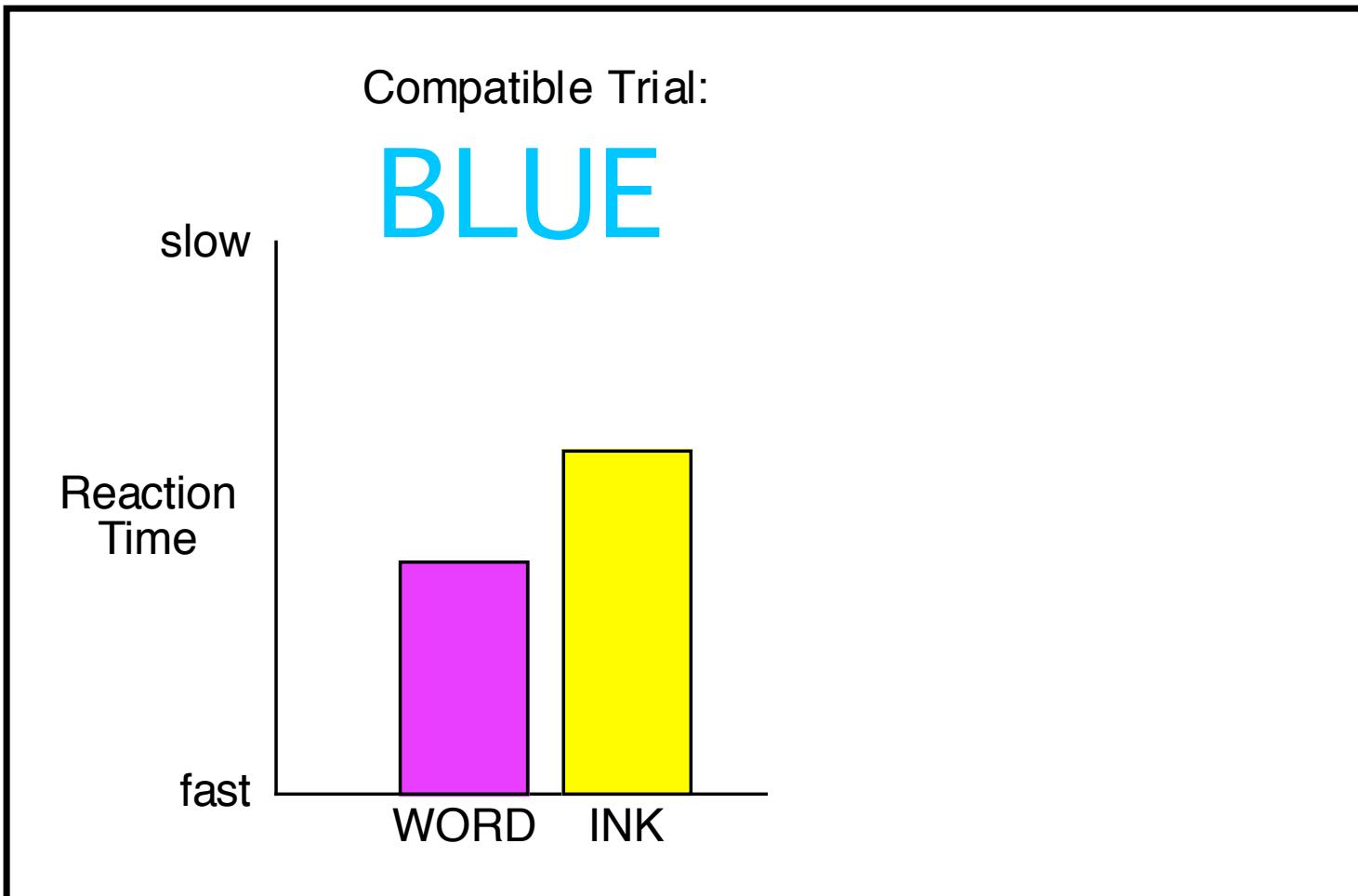
Blue

Red

Red

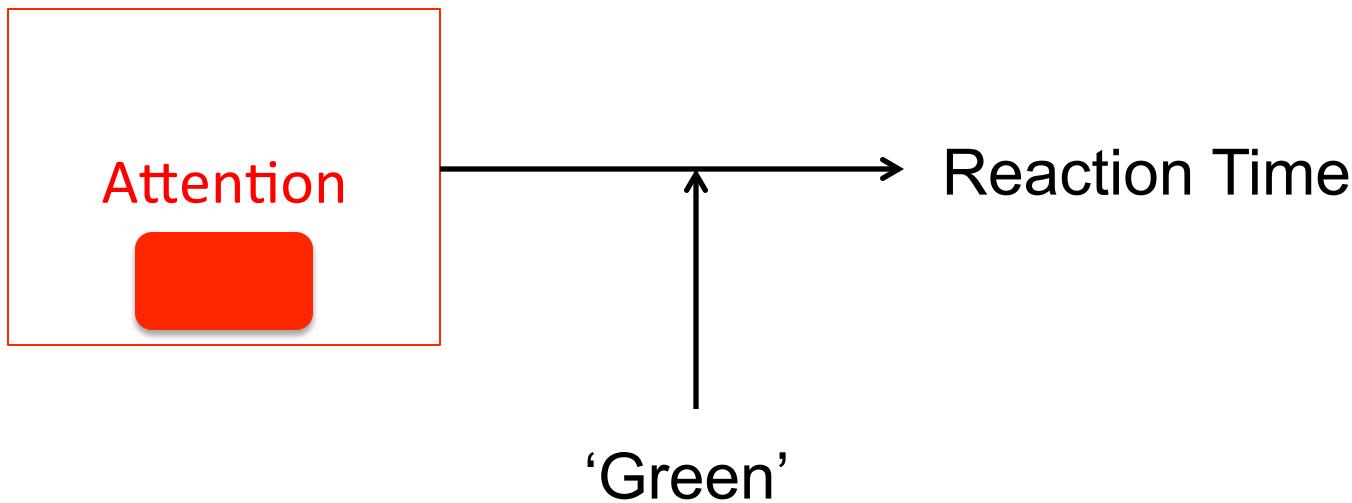
Blue

Think, pair, share



Why is this late selection?

GREEN



- Unattended information
- Gets processed and interferes with attention

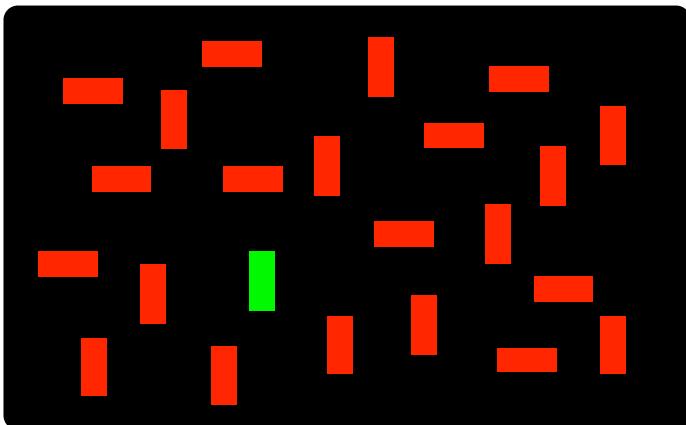
Summary

- Attention selectively biases task-relevant information
- Attentional selection can be early on sensory inputs
- Can also be late so that the to-be-ignored distractors compete for responses

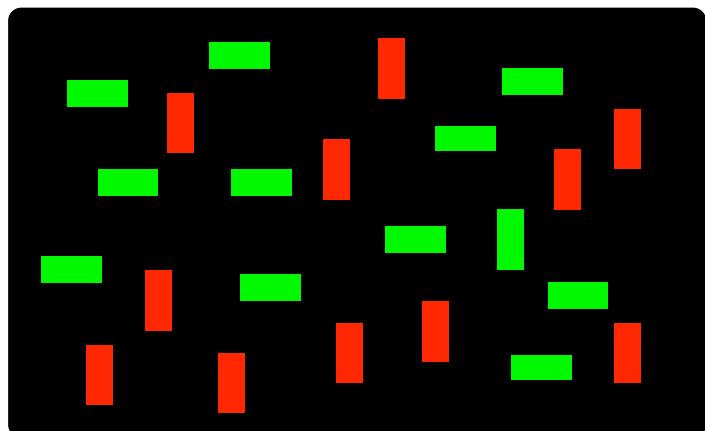
Commonality between early-selection and late-selection?

Not everything can be fully processed. Sacrifices (selected processing of some but not others) need to be made

Visual search



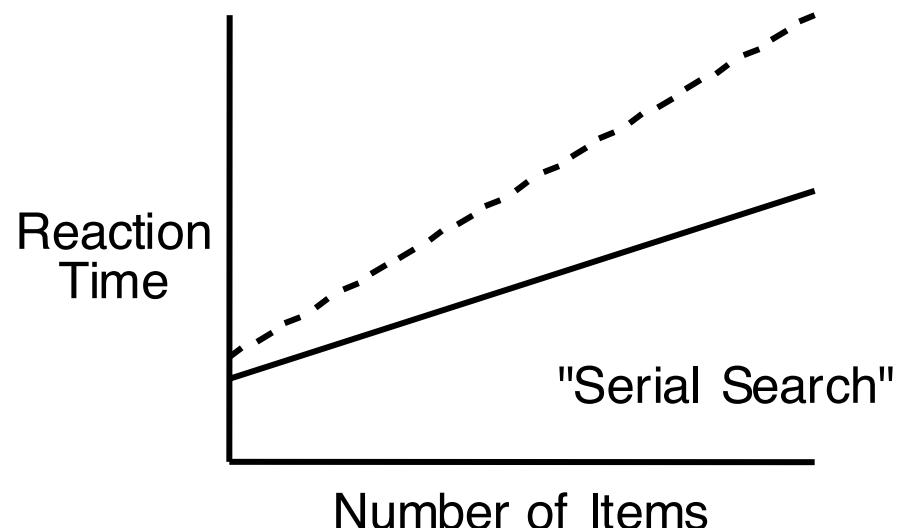
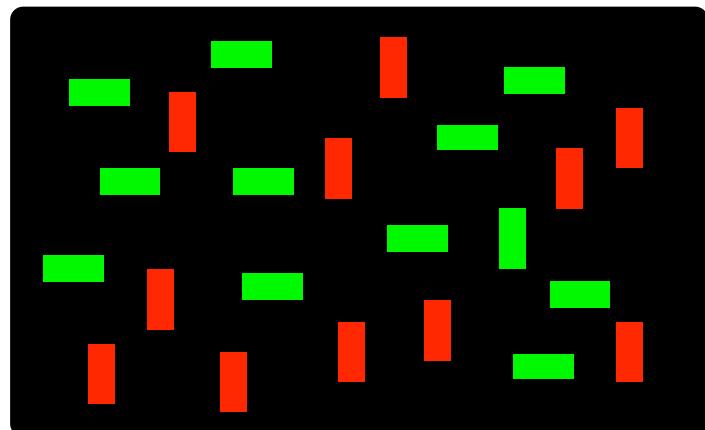
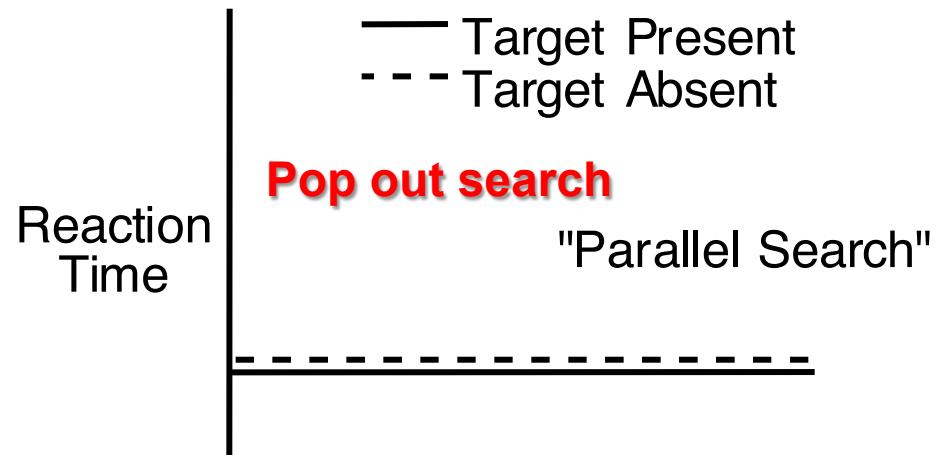
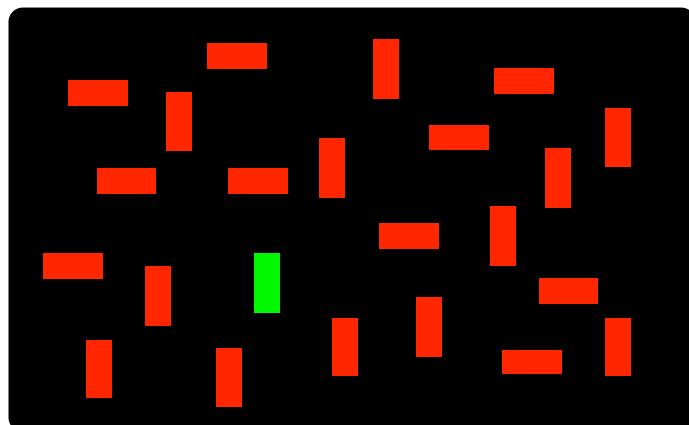
Feature search – search for only one feature (green)



Conjunction search – search for multiple features (green, vertical)

Laboratory version: Press one button for target-present and a different button for target-absent

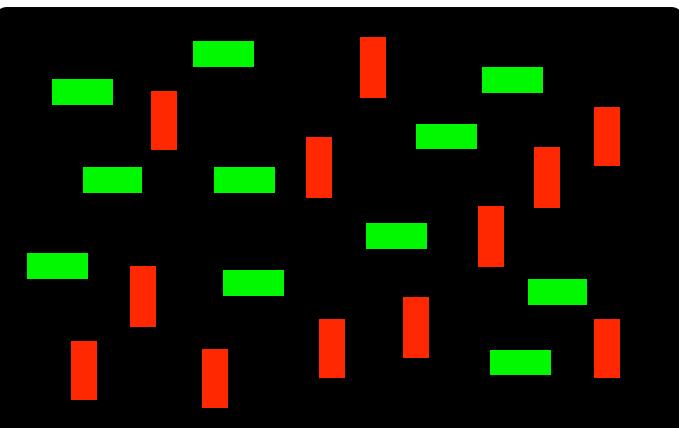
Typical Search Results



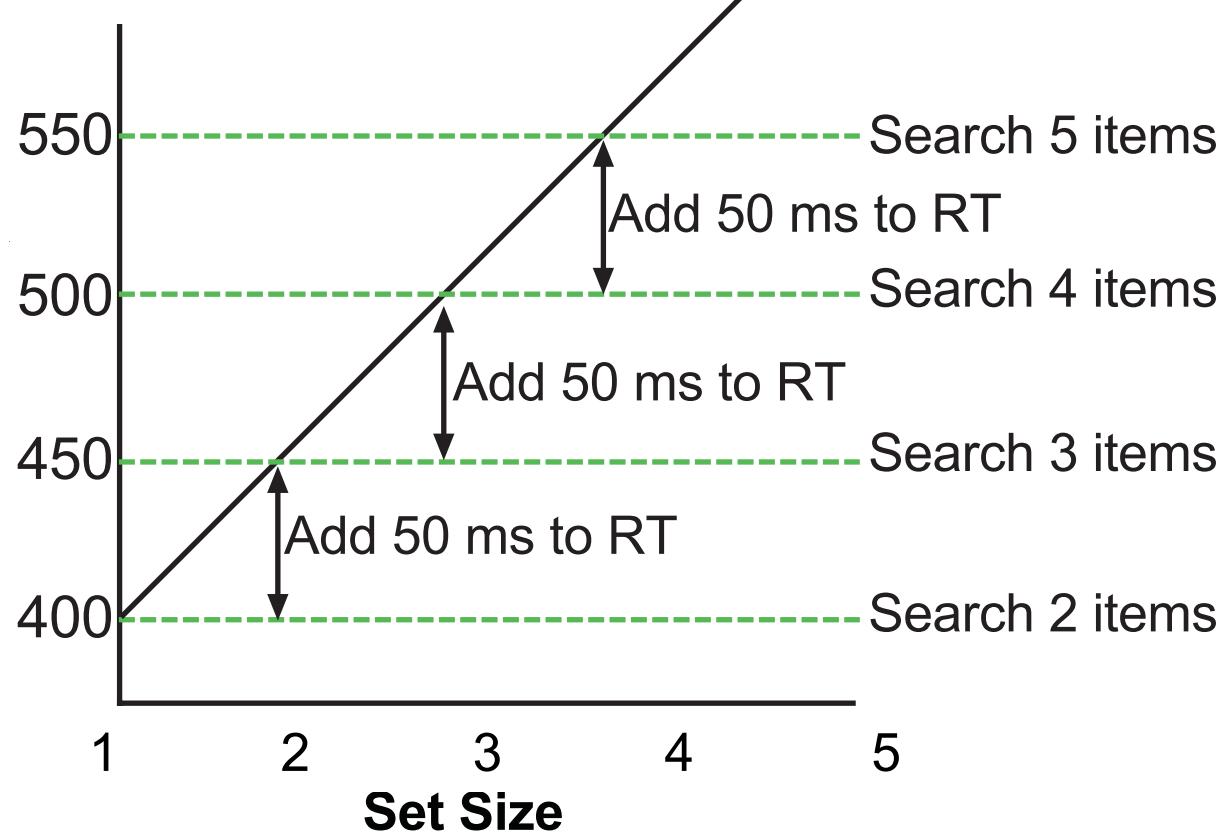
Laboratory version: Press one button for target-present and a different button for target-absent

Search Slopes

Target-absent trial -- Every item must be searched.
RT goes up by 50 ms for each item added to the array
(Slope = 50 ms/item).

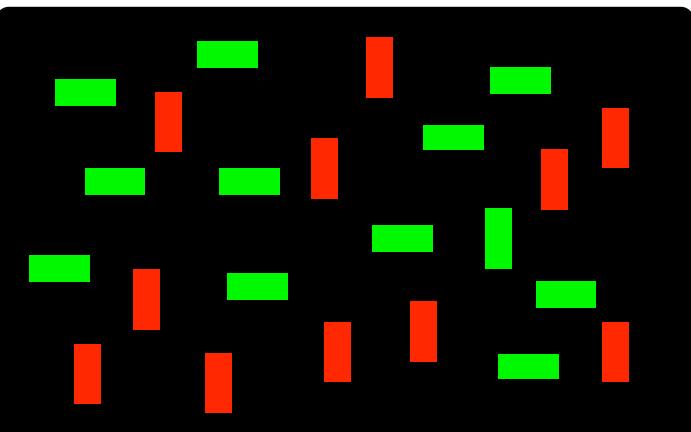


Reaction Time (ms)

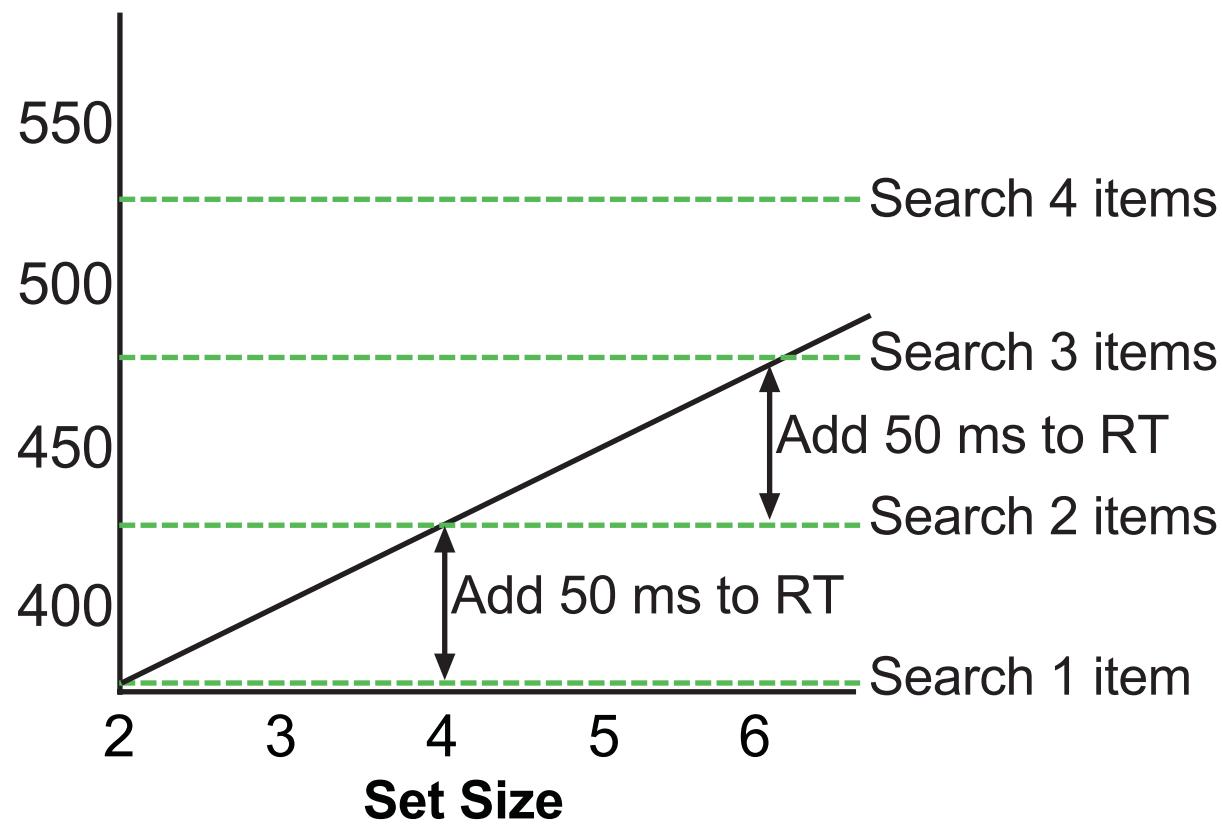


Search Slopes

Target-present trial -- Search half of the items on average.
RT goes up by 50 ms for every 2 items added to the array
(Slope = 25 ms/item).

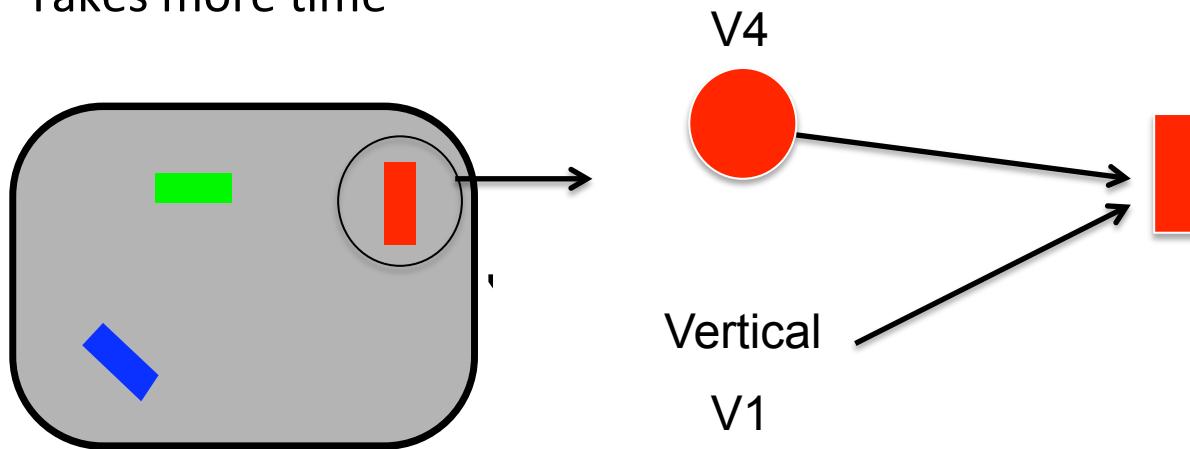


Reaction
Time (ms)



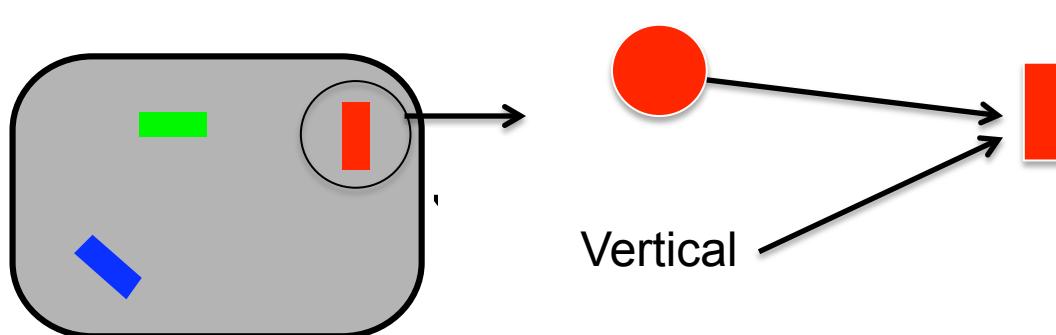
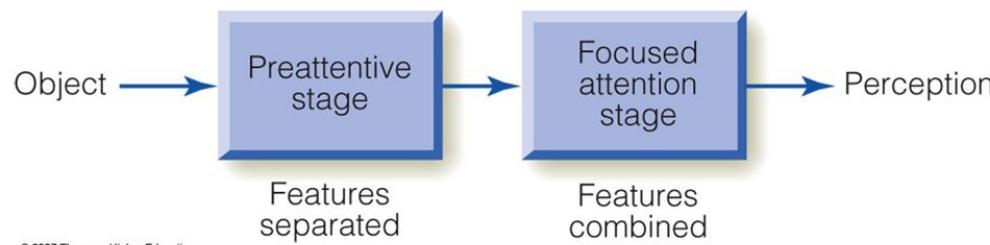
Why is conjunction search slower?

- Feature integration theory
 - Attention is needed to integrate features
 - Feature search – you do not have to attend to each stimulus
 - Conjunction search – you have to attend to each stimulus one at a time (serial)
 - Takes more time



- Feature integration theory
 - Preattentive stage – features *are not* bound together
 - ‘Free floating’, separate maps...
 - Attentive stage – features *are* bound together
 - ‘Localized’, one object file

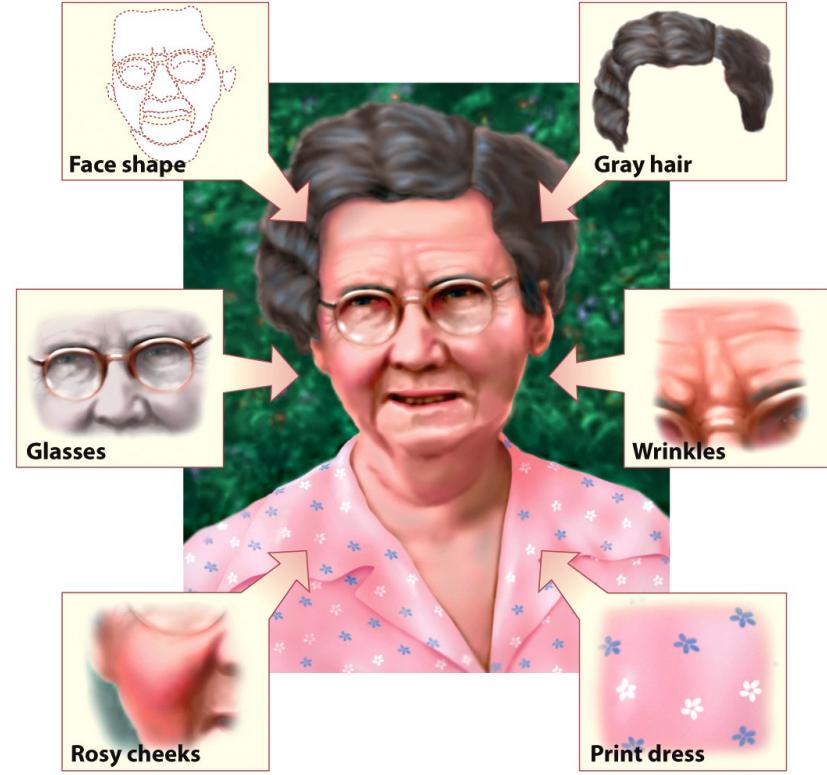
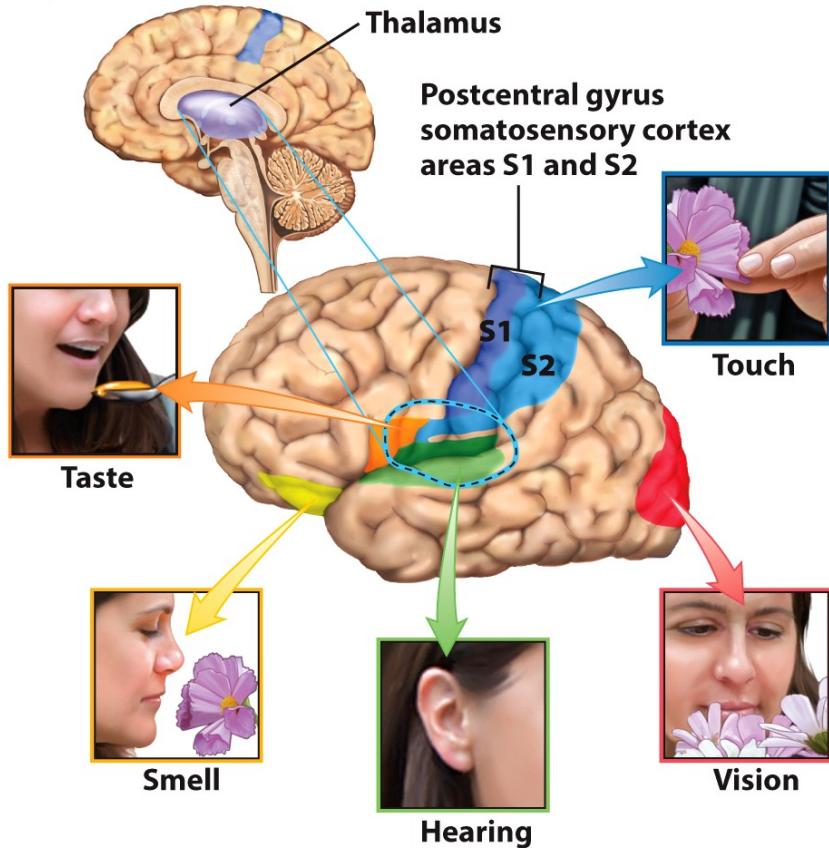
Feature integration theory



Binding Problem

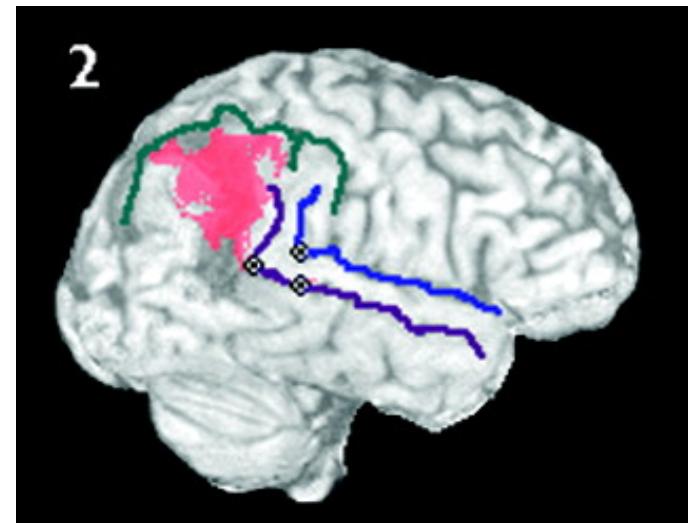
Attention is used to solve **binding problem** in general
Combine information together to form coherent representations

Major sensory regions of the cerebral cortex

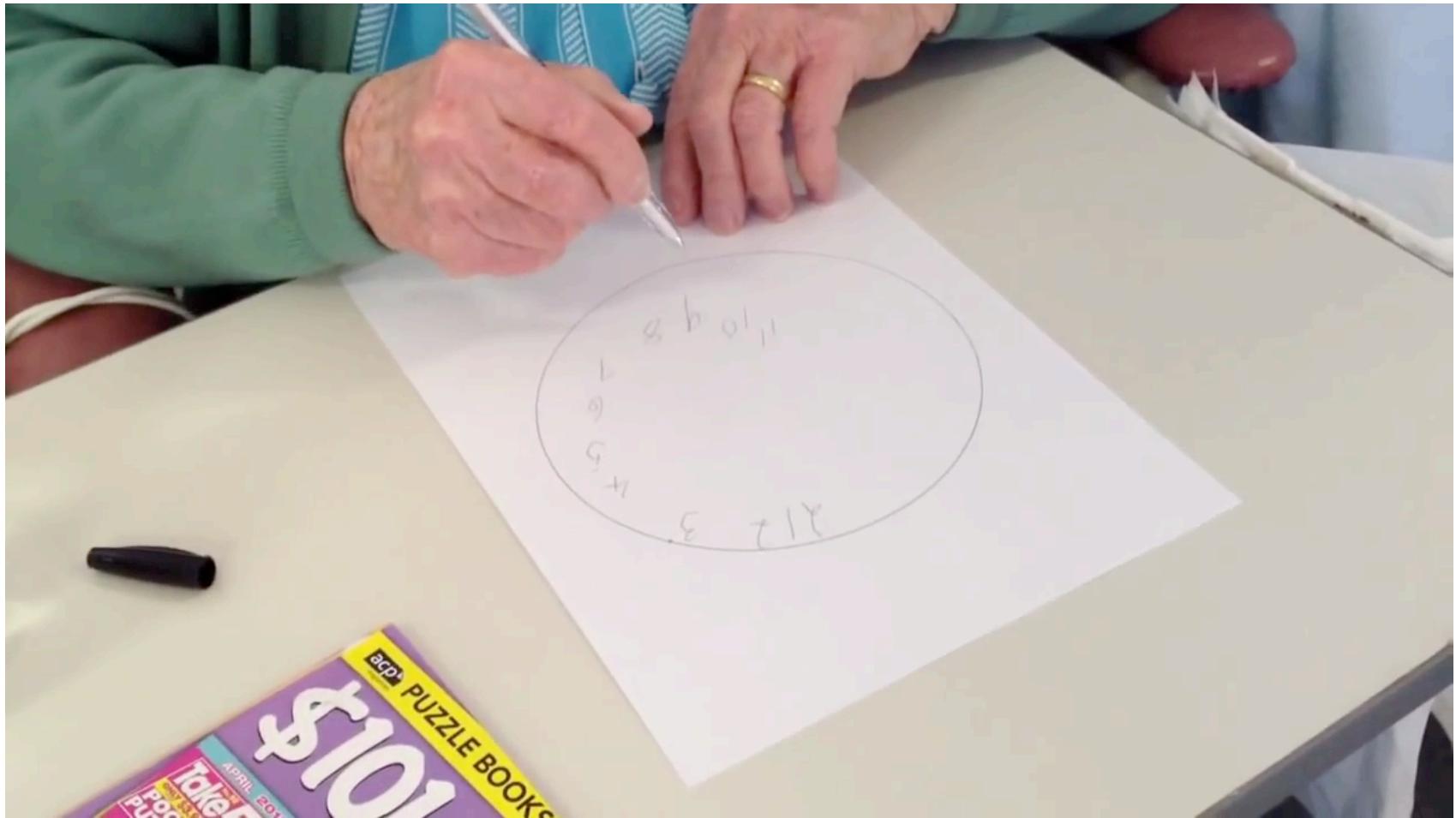


Spatial neglect

- Most commonly associated with damage to parietal cortex
- Jargon
 - Contralesional
 - Opposite side from the lesion
 - Ipsilesional
 - Same side as the lesion



Clock drawing by a neglect patient



Self portraits by Anton Raederscheidt following right hemisphere stroke.

Lack of representation
of information in
contralesional space

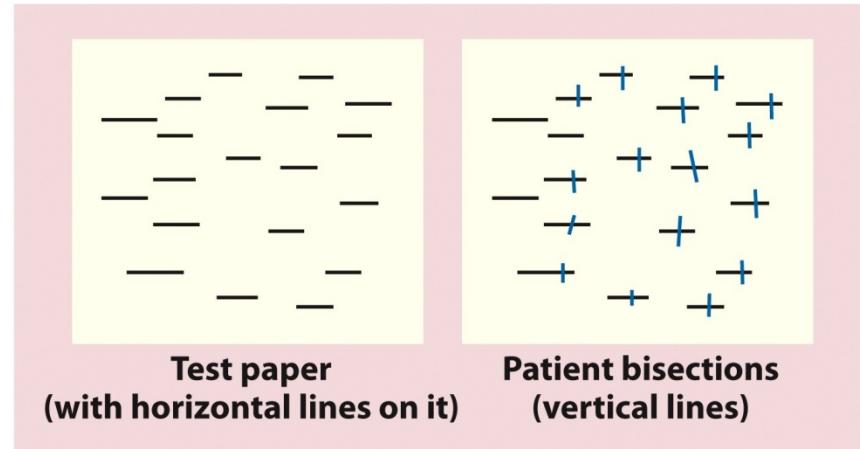
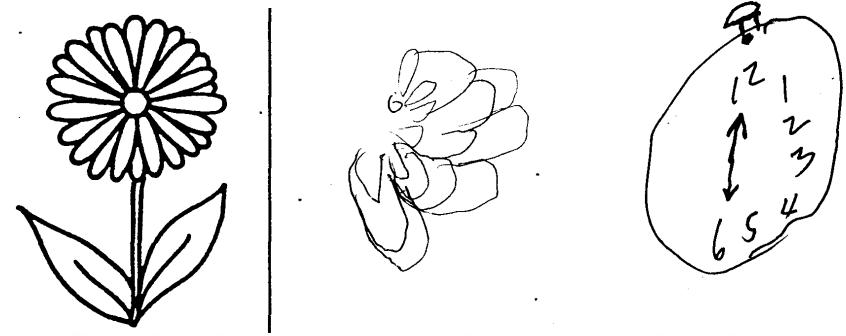
No conscious
awareness of deficit



Gets better over time

Faulty attention: Spatial neglect

- Ignore contralateral space
- Sensory perception (ability to “see”) intact
- But can direct voluntary attention to neglected side (slower than controls)
- Sensory-driven (reflexive) attention very impaired





- Detect and respond (by pointing) to the stimuli if presented one at a time, suggesting no major visual field defects
- However, see only the one in the right visual field when bilateral stimuli were presented simultaneously
- **Extinction**: the simultaneous presence of the stimulus in the patient's right field leads to the stimulus on the left of the patient being extinguished from awareness

Neglect & Extinction

- Patients typically recover over a period of weeks or months, but may be left with long-lasting “*extinction*”
 - When distracted by a stimulus in the ipsilesional visual field, they neglect the contralesional visual field
 - They will respond to a stimulus on the contralesional side if it is alone (no other stimuli)
 - They fail to notice a contralesional stimulus when an ipsilesional stimulus is presented simultaneously

Change blindness



Attention

- Inattentional blindness – failure to notice the existence of an unexpected item
- Change blindness – failure to notice an obvious change

Essentials

- What is attention?
- Behavioral paradigms for studying attention.
- Attention as a limited resource. Bottleneck model.
- Voluntary attention and how voluntary attention affects early perception
 - Effects on ERPs
 - Effects on fMRI.
- Evidence for late selection
- Visual search
- Spatial neglect
- Inattentional blindness and change blindness